Pecans and Cattle: Are They Mutually Beneficial?

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Abstract

Pecan trees can be found across much of the southern United States, and further, the pecan is the only major cultivated nut native to the United States. Pecans also provide promising profit potential for producers with the right conditions. Cattle and pecan trees often coexist across the southern United States, and silvopastoralism (agroforestry) has been shown to be mutually beneficial in some cases. Yet, the value that cattle add to a pecan production system is still unknown. The objective of this paper is to determine the value (cost savings or ancillary benefits) of this silvopastoral system and under what conditions cattle may not be complementary to the pecan production system. An income model will be used for this analysis. It provides a 10-year analysis for production and input and output prices; the firm’s annual income statement, cash flow, and balance sheet are calculated, as well as annual debt servicing costs on capital expenses and replacement and financing of machinery over time. Further, it estimates annual federal income taxes, along with costs from cash flow deficit financing. Results will indicate under what conditions this silvopastoral system is mutually beneficial and identify what factors influence whether these two enterprises can coexist.

Key Words:
Cattle, Pecans, Silvopastoral System, Net Present Value (NPV)
Introduction

Pecan \(Carya\) illinoensis (Wangenh.) C. Koch] trees are native to the Mississippi, Ohio, Missouri, and Red River floodplains and tributaries. From the late 1800s into the early 1900s, pecan orchards became much more popular in the southeastern United States with the majority of new orchards being developed in Georgia and Texas. The development of improved cultivars and chemicals to control pests greatly contributed to the increased interest in the cultivation of pecans (Wood et al., 1990).

Today, pecan trees are the most economically significant fruit-bearing tree that is native to the United States (Springer et al., 2011). Total US exports were over $500 million in 2016, part of a longer-term trend in export growth (FAS, 2017). In 2016 the total in-shell value of improved pecans produced in the United States was valued greater than $663 million while the total in-shell value of native pecans produced that same year was valued just over $33 million (USDA-NASS, 2018). The top producing states in 2016 for improved pecans by dollar value were, in order from greatest to least, Georgia, New Mexico, Texas, and Arizona. The top producing states in 2016 for native pecans by dollar value were, in order from greatest to least, Oklahoma, Texas, Louisiana, and Alabama (USDA-NASS, 2018).

Management styles for pecan production can range from intensively managed, high yielding orchards to those who are merely harvested and little else. A particular orchard may fall anywhere in this range or change position depending upon environmental limitations, available capital, and producer goals, among other things. One management practice may include grazing cattle on the orchard floor. Some benefits of grazing cattle beneath pecan trees include a reduced number of mowings and diversified income. However, integrating cattle in a pecan orchard could cause reduced yields and require additional fencing, equipment, and labor (Landgraf, 1997). Pest
management and cattle management must be carefully integrated because many pesticides may have grazing restrictions which could limit when cattle can graze after an application, if at all. Each management decision ultimately depends on the producer given their specific climate, financial situation, experience, etc.

It is difficult to find resources which directly compare an orchard with or without cattle in an economic sense, primarily analysis of the financial statements. Our model and scenario seek to accomplish this goal for a low-input, native orchard which may or may not incorporate stocker cattle. We anticipate that the addition of cattle will increase the net cash income and net present value of the pecan system.

**Methodology**

Two scenarios were analyzed and compared. The first scenario consists of only a native pecan grove, while the second scenario combines a native pecan grove with summer stocker cattle in a silvopastoral system. For this analysis, a deterministic income simulation model (ISM), spanning over 10 years, was developed to evaluate the economic viability of the farm under the two different management methods.

Outputs from the ISM are net present value (NPV), ending real net worth, annual net cash income, annual ending year cash reserves, total cost of production per acre, and other financial variables important to determining the economic sustainability of a business. Net present value is defined as the present value of annual returns generated by the farm that exits the farm in the form of operator withdrawals and dividends plus the present value of the change in net worth which includes retained earnings. When NPV is positive the farm earns an internal rate of return
greater than the discount rate, which is generally considered to be the rate of return for the producer’s next best alternative investment, in other words, the investment was a success\textsuperscript{1}.

To determine the contribution stocker cattle would make to a pecan grove farm system, a base farm was defined. The base farm was assumed to consist of 250 acres in a native pecan grove, located in South Central Oklahoma. The native pecan grove was assumed not to be intensively managed and have no irrigation. It is assumed that the pecan grove floor is predominately comprised of Bermudagrass. The trees are estimated to produce 675 pounds per acre each year. For management, the pecan grove is mowed three times per year, have three zinc applications, one urea application, and one insecticide application per year.

In the second scenario where summer stocker cattle are incorporated, the cattle are assumed to graze the Bermudagrass from June 1 through August 31\textsuperscript{st} each year and gain 135 pounds in these 90 days. The inclusion of cattle is estimated to reduce the per acre yield by 50 pounds (Landgraf, 1997). For management with cattle, the pecan grove is assumed to be mowed once per year, have three zinc and two urea applications, along with one pesticide application per year. One extra urea application is included to fertilize the grass for the cattle. For each scenario, the only parameters that differ are those that are directly related to the inclusion of cattle in the pecan grove. This includes number of mows, fertilization, pesticide, and yield.

**Results & Discussion**

Between the two scenarios, the pecan only system returns a higher revenue by 4.2%. This lower revenue in the pecan and cattle system is a result of the yield loss that is caused by including cattle in the pecan grove. The revenue that the cattle bring in does not offset the revenue loss of the higher valued pecan crop. Additionally, the total cost of production per acre

\textsuperscript{1}This definition of economic success was originally defined by Richardson and Mapp (1976).
is increased in the pecan only system, albeit 3.2%. The higher total cost of production is due to the increased management (mowing) that is required when no cattle are present.

The combination of the increased revenue and expenses for the pecan only scenario results in an increased net cash income for the scenario as well. The increase in costs is more than offset by the increase in revenue that is received. On average across the ten years, the cattle and pecans scenario observes a 2.8% reduction in net cash income as compared to a system managing for pecans only. Similarly, the ending cash value at year 10 is 3.1% more in the pecan only scenario.

The difference in these financial measures culminates in the NPV for the pecan only scenario being 5.4% higher than the pecan and cattle scenario. In both cases, the NPV is positive, with a value of $374,346 for the pecan only scenario and $355,104 for the pecan and cattle scenario.

There are some possible factors that are difficult to capture in the modeled scenario, however. The presence of cattle can positively impact soil health due to hoof action, re-introduction of organic matter, and nutrient recycling, among others. These effects are difficult to estimate but could possibly favor the scenario in which cattle are present. Additionally, pecan yields would likely vary year to year because of alternate bearing. Having a second source of income would mitigate the risk associated with unpredictable pecan harvest yields. Further, a producer running stocker cattle on gain could choose whether to include this enterprise on an annual basis. The additional capital costs from including cattle are minimal. So, a producer may incorporate stocker cattle into their operation in years where they can get a higher return from the cattle or years where pecan yields are expected to be reduced or prices would be lower. By
strategically choosing years to incorporate cattle, producers may be able to capture the best of both worlds from a financial perspective.

Conclusions

There are many complex factors surrounding management decisions, and a producer trying to determine whether to incorporate cattle into their operation would rely on many sources of information to supplement a Net Present Value assessment. Knowledge, experience, and threshold of acceptable risk would also play a role in a producer’s choice to integrate cattle or not. While this analysis suggests that the producer would be better off to focus on the production of native pecans only that does not mean that grazing cattle in a pecan orchard is always a lesser choice. Different scenarios could have different results. In all, a positive net present value in the chosen scenarios of the model farm indicate that integrating stocker cattle into the native pecan orchard is not a poor decision but rather one that may be associated with an opportunity cost that manifests primarily in the form of a smaller pecan harvest yield.
References


Oklahoma State University, Department of Agricultural Economics. “Oklahoma Farm and Ranch Custom Rates, 2015-2016.” http://factsheets.okstate.edu/wp-content/uploads/2017/03/Reporting-Region-Table.pdf


Appendix: Summary of Input Values for the Analysis

Farm Assumptions
- Number of Acres 250
- Price per Acre $2,170
- Trees per Acre 48
- Average Tree Diameter 24 in.
- Yield per Acre (pounds/acre)
  - Pecans Only 675
  - Pecans & Cattle 625
- Meat yield 42%
- Pecan Price ($/point) $4.00
- Stocker Beginning Weight (pounds) 500
- Stocking Rate (animals/acre) 1.14
- Number of Grazing Days 90
- Number of Head 220
- Average Daily Gain (pounds) 1.5
- Ending Weight (pounds) 635
- Grazing Revenue ($/lb gained) $0.40

Financial Assumptions
- Beginning Cash Reserves $50,000
- Discount Rate 10%
- Fraction of Year Operating Loan 0.5
- Capital Expenses (CAPEX) Debt Interest Rate 7%
- CAPEX Loan Length 30 years
- Fraction of Cost Financed 60%
- Operating Expenses (OPEX) Interest Rate 6.5%
- Fraction of Machinery Replacements Financed 80%
- Number of Years for Machinery Replacement Loans 5 years
- Interest Rate for Machinery Replacement Loans 7%
- Dividends as a Fraction of NCI 7.5%
- Dividends as a Fraction of Initial Equity 2.5%
- Property Tax Rate 1.18%

**CAPEX Input Values**
- Land $542,500
- Dump Wagon $7,300
- Portable Pens $12,500
- Livestock Trailer $20,000

**OPEX Input Values**
- Mowing
  - Cost per Mowing ($/acre) $14.80
- Fertilization
  - Zinc Fertilizer Applied (lb/acre) 18
  - Zinc Fertilizer Price ($/lb) $1.18
  - Cost per Zinc Application ($/ac) $5.41
  - Urea Fertilizer Applied (lb/acre) 330
  - Urea Fertilizer Price ($/lb) $0.17
  - Cost per Urea Application ($/ac) $5.69
- Pesticide
  - Pecan Nut Casebearer Application Rate (gallons/ac) 0.05
  - Pecan Nut Casebearer Cost ($/gallon) $280
  - Pecan Weevil Application Rate (gallons/acre) 0.02
  - Pecan Weevil Cost ($/gallon) $125
  - Cost per Fertilization Application ($/ac) $5.19
- Fungicide
  - Fungicide Applied (gallons/ac) 0.09
  - Fungicide Cost ($/gallon) 210
  - Cost per Fungicide Application ($/ac) $5.19
- Harvesting Cost ($/lb) $0.53